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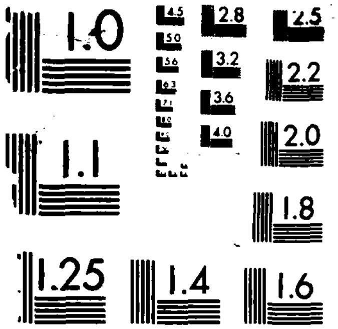
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Construction Engineering
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Managing Underground Storage Tank Data Using dBASE III PLUS

by
Bernard A. Donahue
Theresa J. Hoctor
Kemal Piskin

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The Department of the Army owns approximately 10,000 underground storage tanks (USTs), many of which are old and may be leaking. Under Public Law 94-580, the Resource Conservation and Recovery Act of 1976, Section 9002, installations owning tanks were required to collect and report data on them by May 1986. USA-CERL has created data base structures, using the dBASE III PLUS software package and microcomputers, which allow this data to be stored, organized, and manipulated. One of the outputs is a Leak Potential Index, to prioritize UST s in order of potential for leakage. This report documents the data bases that were developed. In addition, an appendix provides a short introduction to dBASE III PLUS for the novice user.

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The Department of the Army owns approximately 10,000 underground storage tanks (USTs), many of which are old and may be leaking. Under Public Law 94-580, the Resource Conservation and Recovery Act of 1976, Section 9002, installations owning tanks were required to collect and report data on them by May 1986. USA-CERL has created data base structures, using the dBASE III PLUS software package and microcomputers, which allow this data to be stored, organized, and manipulated. One of the outputs is a Leak Potential Index, to prioritize USTs in order of potential for leakage. This report documents the data bases that were developed. In addition, an appendix provides a short introduction to dBASE III PLUS for the novice user.

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FOREWORD

The programs which this user's manual documents were developed for the Office of the Chief of Engineers under Project 4A162720A896, "Environmental Quality Technology"; Technical Area A, "Installation Environmental Management"; Work Unit 032, "Treatment Technology for Hazardous Waste." Mr. Wilford Shaw, DAEN-ZCF-U, was the Technical Monitor.

The work was done by the Environmental Division (EN) of the U.S. Army Construction Engineering Research Laboratory (USA-CERL). The Principal Investigator was Mr. Bernard A. Donahue who directed the development of the data base system; the system itself was developed by Ms. Theresa J. Hoctor. Dr. Alex Mathews, Associate Professor of Civil Engineering, Kansas State University, researched and formulated the Leak Potential Index. Technical support was provided by Mr. Ashok Kumar and Mr. Vince Hock. The contributions of Mr. Kemal Piskin and Ms. Britta J. Langsjoen are appreciated. Ms. Jane Andrew, Information Management Office, was the technical editor.

Dr. R. Jain is chief of USA-CERL-EN. Dr. L. R. Shaffer is Technical Director and COL Norman C. Hintz is the Commander and Director of USA-CERL.

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MANAGING UNDERGROUND STORAGE TANK DATA USING dBASE III PLUS

1 INTRODUCTION

Background

Many organizations, including the Army, use underground storage tanks (USTs), often storing hazardous materials in them. Under Section 9002 of the Resource Conservation and Recovery Act of 1976 (RCRA), Public Law 94-580, owners of tanks over 1100 gal were required to report information on these tanks to the U.S. Environmental Protection Agency (EPA) by May 1986. The purpose of this notification program was to locate and evaluate underground tanks containing petroleum or hazardous substances. The information was compiled by tank owners and entered on EPA Forms 7530-1 (11-85), "Notification for Underground Storage Tanks," which were submitted to the EPA.

The Army reported information on over 10,000 USTs. Installations completed the EPA forms, which were then transferred to the EPA. Approximately 15 percent of the Army's tanks contain hazardous or unknown materials. Many of these tanks are over 20 years old and have a high potential for leakage. Using the reported data, USA-CERL has developed a data base which will simplify the record-keeping process associated with these tanks. A Leak Potential Index (LPI) was also devised which indicates the likelihood of individual tank leakage. This LPI value was based on the submitted tank information as well as general soil data obtained from the U.S. Soil Conservation Service. The LPI is a tool which enables tank managers to prioritize their tanks into groups of tanks from most likely to leak to least likely to leak. This information will indicate which tanks should be monitored more closely, which tanks should be tested, and which tanks should be considered for replacement.

Purpose

The purpose of this report is to describe the organization of the collected UST data and how dBASE III PLUS* software is used to manage it.

Approach

The first section of this report details the development of the data bases which store the UST data, while the second section documents their structure and describes the programs used to enter and organize this data. Appendix A is intended for the novice dBASE III PLUS user, or for a user who desires a quick review. It is a short introduction to the major features of this software package, illustrated with examples that use the UST data.

---

*dBASE III PLUS is a trademark of Ashton-Tate.

The data base described in this report was developed using dBASE III PLUS for use on an IBM Personal Computer, IBM AT, IBM XT, or 100 percent compatible machine, equipped with a 20 Mbyte hard disk. A hard disk is necessary because of the enormous amount of data in the UST data base. A minimum of 700 Kbytes of memory space is necessary to run dBASE III PLUS on a hard disk. To use the entire UST data base system, approximately 7 Mbytes must be free on the hard disk. However, substantially less disk storage is needed if only a subset of the UST data is used; the amount needed depends on the size of the subset.

dBASE III PLUS runs with IBM PC-DOS releases 2.0, 2.10, and all versions of release 3, and with MS-DOS release 2.11 if 384 Kbytes of RAM is available. If less than 384K RAM is available, see the dBASE III PLUS manual "Getting Started" for further instructions. Consult the dBASE III PLUS manuals for more detailed memory and hardware requirements.

Mode of Technology Transfer

In July 1987 USA-CERL will distribute the UST data base system to MACOMs. This will include an instructional workshop in the use of dBASE III PLUS with emphasis on manipulating the UST data. The MACOMs will receive a copy of their own tank data and copies of the system as developed by USA-CERL. The dBASE III PLUS software will be purchased for the individual installations. Maintenance and upgrading of the UST data base will be accomplished with future contracts. It is planned that updates will be implemented by having the installations issue tank updates to the maintaining organization.

2 DEVELOPMENT OF THE UST DATA BASE MANAGEMENT SYSTEM

In the process of complying with Public Law 94-508, it became clear that the Army needed a data base management system to handle the vast quantities of UST data that had been generated. In 1985, USA-CERL began developing this system, in cooperation with the Facilities Engineering Division of the Office of the Assistant Chief of Engineers, U.S. Army Corps of Engineers (DAEN-ZCF).

USA-CERL investigated the available data base management software packages through discussion with in-house experts and literature searches. dBASE III PLUS was chosen for its data base management capabilities and advanced user friendliness.

The primary purpose of the UST data base management system is to store, organize, and manipulate the data that installations provided on EPA Form 7530-1 (11-85). This data was split into two categories: addresses and physical information (age, size, contents, etc.). It was entered in two data base files: MASTADDR.DBF and MASTINFO.DBF, respectively. The information in these two files is related through the key field LINK, which is a unique identifier of a site at which a tank (or tanks) is located. The linkage is accomplished using the relational mechanism of dBASE III PLUS.

The data was entered in the data base files directly from the EPA forms using data entry programs which created screen designs that mimicked the form. The physical data entry was done by USA-CERL support personnel. In general, the data was entered as it appeared on the EPA Forms with very few changes, except for standardizing abbreviations and the names of installations.

Report forms were designed to summarize the data stored in the data base files. These reports organize the data by installation and by MACOM. This break-out was specified by DAEN-ZCF. (See Appendix C for a sample report form.)

An important part of the UST system which was not derived directly from the EPA form is the Leak Potential Index (LPI). An LPI value is assigned to every tank in the data base system, giving each tank a ranking which prioritizes them in order of potential for leakage. It can be used to indicate which tanks should be closely monitored, tested, or considered for replacement. This index can have one of six values: VERYHIGH, HIGH, MEDIUM, LOW, VERYLOW, and NODATA. VERYHIGH indicates a high potential for leakage, and VERYLOW indicates a low potential for leakage. NODATA indicates that information was insufficient to accurately make a prediction.

The LPI value is calculated from several tank and soil parameters.[1] The tank information was obtained from the EPA forms. The soil information was obtained from the U.S. Soil Conservation Service Data Base, maintained at Iowa State University. It contains information for each soil type in each county and state in the United States. This index was only calculated once; the values generated were stored in MASTINFO.DBF. The program first returns a numerical value, based on a single soil type. However, since soil types can vary widely, an average was taken of the highest LPI value and the lowest in the region of the tank. Depending on what range this average value fell in, a ranking was assigned (VERYHIGH, etc.). The various characteristics of the tanks and soil used to calculate the LPI are given below, along with the final equation.

---

[1] Ashok Kumar and Vince Hock, "Implementation of a Pipe Corrosion Management System," paper 312, *Corrosion 87*, (National Association of Corrosion Engineers, March 1987).

Tank parameters and values computed using them:

capacity : tank capacity in gallons, used to calculate thickness and area
thickness : tank wall thickness in mils (1/1000 of an inch)
area : exterior surface area of tank in square feet
age : age of tank: current year minus year tank was installed

Soil parameters and values computed using them:

salinity : salinity of the soil; used to compute rho
rho : soil resistivity: 1000/salinity
perm : permeability of the soil, used to compute kn and n
kn : constant based on permeability
n : constant based on permeability
ka : constant
a : constant
ainv : constant; the inverse of a
ph : pH of the soil
pct : percent of this soil type in this county
cf : computed in the program CF.PRG, based on these fields in the soil data base:
    swell : soil shrink/swell
    ncomp : number of components or types of soils associated with each tank
    flood : flooding frequency for high water tables
    watertabl : depth of water
lpi : LPI value, the average of the highest and the lowest LPI values obtained from all the different soil types in the region in which the tank is buried.

The LPI formula is:

$$\begin{aligned} \mathrm{LPI} \;=\; & (\mathrm{area}) \times \{(\mathrm{kn} \times \mathrm{ka} / \mathrm{thickness})^{\mathrm{ainv}} \\ & \times [\mathrm{age} \times (10 - \mathrm{ph}) / \mathrm{rho}]^{(n/a)}\} \times (\mathrm{cf}) \times (\mathrm{pct}) \ldots\ldots\ldots (\mathrm{Eq}\ 1) \end{aligned}$$

USA-CERL is interested in testing the validity of the LPI value. This would be done by studying the degree of leakage in previously excavated tanks and by field testing buried tanks. Presently, these tests are in the developmental stage. When the LPI index is verified, necessary measures will be taken to repair those tanks with VERYHIGH LPI values, since these tanks pose the greatest threat to the environment.

The UST system is continuing to evolve. Applications are being developed to integrate the UST data and dBASE III PLUS software more effectively. These applications will create a more user friendly environment that will simplify the process of using the UST data. For example, using the Assistant facility a user can delete any file at all, accidentally or otherwise. The applications will restrict this and other potentially harmful operations, while making operations such as report generation, retrievals, and updates more accessible. These enhancements are still being developed and will be documented at a later date.

3 UST FILE DESCRIPTIONS

This chapter provides general descriptions of the files used to store, manipulate, and retrieve data, and the program files which were used to establish, and will be used to maintain, the UST data base management system. In addition, the structure of the data base files is given in detail.

Catalog

Several files are listed in the UST.CAT catalog. This enables the Assistant to give a description of each file. The list of files in the UST.CAT catalog is dynamic, changing as the user creates and deletes files for manipulating the UST data.

Data Base Files

The following data base files are used in the UST project: MASTADDR, MASTINFO, SUMMARY, SOILS, LEAK, STATE, INSTALLA, ADDR, and INFO (all have the extension .DBF). All information in these files is stored in capital letters.

Information was entered in MASTADDR.DBF and MASTINFO.DBF with the data entry programs INPUT.PRG, INPUTA.PRG, and INPUTC.PRG (described later). The information was entered basically as it appeared on EPA Form 7530-1 (11-85); very few evaluations of its accuracy or validity were made. In the absence of information, one of three entries was made: (1) zero, for a numeric field; (2) "unknown", for a character field for which "unknown" was one of the options given; (3) nothing, for a character field for which "unknown" was not an option. (See Appendix D for an example of the EPA form.)

MASTADDR.DBF	(MASTer ADDRess) Holds the textual information concerning the addresses of tank owners and the locations of the actual tanks. All data in this file was extracted directly from the EPA form (Sections I and II) except for the LINK and T_ID fields. The data base file contains 12 fields, which are described in Table 1.
MASTINFO.DBF	(MASTer INFOrmation) Holds the information concerning the individual tanks, found in Section IV of the EPA form. This file contains 19 fields, some of which contain coded information. The fields are described in Table 2, and the codes are given in Table 3.
SUMMARY.DBF	Contains summary information computed using a combination of information from MASTADDR.DBF and MASTINFO.DBF. Each record presents information for a unique installation. Note that this differs from MASTADDR.DBF, in which each record contains information about a particlar location where a tank is buried. The information stored in SUMMARY.DBF is totals of tanks at locations that fall in certain categories. The fields in this data base file are given in Table 4.

Table 1

Data Fields in MASTADDR.DBF

Name	Type	Length	Source	Description
LINK	Character	10	*	Unique identification of a location; used as link between MASTADDR.DBF and MASTINFO.DBF (most important field in this file)
MACOM	Character	15	ENVIRONMENTAL PROGRAM GUIDE HNDSP-84-099-ED-PM	The major command of the U.S Army to which the installation belongs
INST	Character	30	EPA Form Sect. I, "Owner name"	Installation name
STATE	Character	2	EPA Form, Sect. I, "State"	State where installation is located; postal abbreviation
ZIP	Character	10	EPA Form, Sect. I, "Zip Code"	Zip code of installation, 9-digit format
LOC_NAME	Character	45	EPA Form, Sect. II	Address of a specific tank
LOC_STREET	Character	20		
LOC_COUNTY	Character	20		
LOC_CITY	Character	20		
LOC_STATE	Character	2		
LOC_ZIP	Character	10		
LOC_NUM_T	Numeric	4	EPA Form,	Number of tanks at a specific site. This is the total number of tanks at a given location, not at a given installation. Determines the number of records in MASTINFO.DBF corresponding to each record in MASTADDR.DBF. (These numbers were carefully checked against the actual records in MASTINFO.DBF.)

**Inventory of Army Military Real Property: The United States* (Department of the Army, Office, Chief of Engineers, 30 September 1985).

Table 2

Data Fields in MASTINFO.DBF

Name	Type	Length	Source	Description
LINK	Character	10	*	Unique identification of a location; links to MASTINFO.DBF to MASTADDR.DBF. Several records in MASTINFO.DBF can have the same LINK field because there can be several tanks at the same location.
T_ID	Numeric	4	#'d sequentially as on form	Each tank was assigned a sequential number 1,2,3,...n where n is the total number of tanks at that location, which should equal value of LOC_NUM_T for the corresponding *record in* MASTADDR.DBF.
TANKNAME	Character	10	EPA Form	Name given the tank by the installation that owns it.
LPI	Character	8	LPI.PRG	Value for the Leak Potential Index, returned by the Leak Potential Index Program: the probability that the tank is leaking or is likely to leak.
YEAR	Numeric	4	Computed from age given on EPA Form	Year the tank was installed. Computed by input programs. From this field, the age can be computed.

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*Inventory of Army Military Real Property: The United States (Department of the Army, Office, Chief of Engineers, 30 September 1985).

Table 2 (Cont'd)

Name	Type	Length	Source	Description
CAPACITY	Numeric	8	EPA Form, Sect. VI, Block 3	Capacity of tank in gallons.
STATUS *	Character	4	EPA Form, Sect. VI, Block 1	
MATERIAL *	Character	10	EPA Form, Sect. VI, Block 4	
INTERNPROT *	Character	15	EPA Form, Sect. VI, Block 5	
EXTERNPROT*	Character	16	EPA Form, Sect. VI, Block 6	
PIPING *	Character	16	EPA Form, Sect. VI, Block 7	
EMPTY	Character	1	EPA Form, Sect. VI, Block 8a	
PETRO *	Character	15	EPA Form, Sect. VI, Block 8b	
HAZ_SUBST *	Character	25	EPA Form, Sect. VI, Block 8c	
UNKNOWN *	Character	1	EPA Form, Sect. VI, Block 8d	
RETIRED	Character	5	EPA Form, Sect. VI, Block 9a	Date tank was retired: mm/yy
REMAIN_GAL	Numeric	8	EPA Form, Sect. VI, Block 9b	
INERT	Character	1	EPA Form, Sect. VI, Block 9c	

---

*These fields contain coded information: see Table 3 for the codes.

Table 3

Coded Data in MASTINFO.DBF

<table>
<tr><th>Fieldname</th><th>Width</th><th>Codes*</th></tr>
<tr><td>STATUS</td><td>4</td><td>|C T P B|
1 2 3 4|

C = Currently in use
T = Temporarily out of use
P = Permanently out of use
B = Brought into use after 5/8/86</td></tr>
<tr><td>MATERIAL</td><td>10</td><td>S
C
F
U
Other
|1234567890|

S = Steel
C = Concrete
F = Fiberglass reinforced plastic
U = Unknown
Other = Other, please specify</td></tr>
<tr><td>INTERNPROT</td><td>15</td><td>|CINU Other---->|
123456789012345

C = Cathodic Protection
I = Internal Lining (eg.,epoxy resins)
N = None
U = Unknown
Other = Other, please specify</td></tr>
<tr><td>EXTERNPROT</td><td>16</td><td>|CPFNU Other---->|
1234567890123456

C = Cathodic protection
P = Painted
F = Fiberglass reinforced plastic
N = None
U = Unknown
Other = Other, please specify</td></tr>
</table>

---

*Codes are taken from first letter of phrases in Section IV of EPA Form 7530-1 (11-85); see Appendix D.

Table 3 (Cont'd)

Coded Data in MASTINFO.DBF

<table>
<tr><th>Fieldname</th><th>Width</th><th>Codes*</th></tr>
<tr><td>PIPING</td><td>16</td><td>|BGFCU Other---->|
1234567890123456
B = Bare steel
G = Galvanized steel
F = Fiberglass reinforced plastic
C = Cathodically protected
U = Unknown
Other = Other, please specify</td></tr>
<tr><td>PETRO</td><td>15</td><td>|DKGO Other---->|
123456789012345
D = Diesel
K = Kerosene
G = Gasoline (including alcohol blends)
O = used Oil
Other = Other, please specify</td></tr>
<tr><td>HAZ_SUBST</td><td>25</td><td>|H CERCLA---> CASNO----> M|
1234567890123456789012345
H = Hazardous substance
CERCLA = Please indicate Name of Principal CERCLA Substance
CASNO = Chemical Abstract Service (CAS) No.
M = Mixture</td></tr>
<tr><td>UNKNOWN</td><td>1</td><td>|U|
1
U = Unknown</td></tr>
</table>

---

*Codes are taken from first letter of phrases in Section IV of EPA Form 7530-1 (11-85); see Appendix D.

Table 4

Data Fields in SUMMARY.DBF

Field	Type	Length	Description
MACOM	Character	15	Major command, taken from MASTADDR.DBF
STATE	Character	2	State abbreviation, taken from MASTADDR.DBF
INST	Character	30	Installation name, taken from MASTADDR.DBF
NUM_TANKS	Numeric	3	Total number of tanks at this installation; note that this differs from the field in MASTADDR.DBF, LOC_NUM_T, since LOC_NUM_T is the total number of tanks at a given location and a single installation may own tanks in several different locations.
LPI_VHIGH	Numeric	3	Number of tanks at this installation with an LPI value of VERYHIGH *
LPI_HIGH	Numeric	3	LPI value is HIGH
LPI_MEDIUM	Numeric	3	LPI value is MEDIUM
LPI_LOW	Numeric	3	LPI value is LOW
LPI_VLOW	Numeric	3	LPI value is VERYLOW
LPI_NODAT	Numeric	3	LPI value is NODATA
A0	Numeric	3	No age, or unknown, on EPA Form
A10	Numeric	3	Age less than 10 years and not equal to 0
A10_30	Numeric	3	Age greater than or equal to 10 years but less than or equal to 30 years
A30	Numeric	3	Age greater than 30 years

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*All the numeric fields in this data base contain the number of tanks at the installation which meet the condition specified in the description; the installation is identified in the first three fields.

Table 4 (Cont'd)

Data Fields in SUMMARY.DBF

Field	Type	Length	Description
C0	Numeric	3	Capacity equals 0 gal
C1100	Numeric	3	Capacity less than 1100 gal, but not equal to 0 gal
C1100_10K	Numeric	3	Capacity greater than 1100 gal but less than 10,000 gal
C10K	Numeric	3	Capacity greater than or equal to 10,000 gal
MAT_STEEL	Numeric	3	Constructed of steel
MAT_CONCRT	Numeric	3	Constructed of concrete
MAT_FIBER	Numeric	3	Constructed of fiberglass reinforced plastic
MAT_UNK	Numeric	3	Material of construction is unknown
STAT_CURR	Numeric	3	Tank is currently in use
STAT_TEMP	Numeric	3	Tank is temporarily out of use
STAT_PERM	Numeric	3	Tank is permanently out of use
STAT_BROUG	Numeric	3	Tank is brought into use after 5/8/86
EXT_PROT	Numeric	3	Externally protected with either cathodic protection, paint, or fiberglass reinforced plastic coating
EXT_NONPRO	Numeric	3	Not externally protected, marked as "none" or"unknown" on the EPA form

SOILS.DBF	Contains information about soil types, which was obtained from the U.S. Soil Conservation Service Data Base, maintained at Iowa State University. It contains data for each soil type in each county and state in the United States. This soil information is accessed by LPI.PRG (Leak Potential Index Program, described later) and used in computing the leak potential index for each tank. Due to the large volume of soil data in the U.S. Soil Conservation Service Data Base, only the soil information for the tanks already entered in MASTINFO.DBF was extracted and stored in SOILS.DBF. The fields in this data base file are given in Table 5.
STATE.DBF	Stores the complete name and two-letter abbreviation of each of the states and of Puerto Rico. This information is used in conjunction with the SOILS.DBF data.
INSTALLA.DBF	Lists the major commands of the U.S. Army. It is used only as a reference for determining the correct entry in the MACOM field of MASTADDR.DBF.
ADDR.DBF	Contains no records. It is a shell where new data is saved while it is being entered using the data entry programs. Later, the new data can be edited and appended to MASTADDR.DBF. By storing new data in a separate file, the person inputting the new data cannot affect the existing data.
INFO.DBF	Serves a similar purpose as ADDR.DBF; the new data saved in this file is later appended to MASTINFO.DBF.
LEAK.DBF	Will store information on the leak history of the tanks. Currently, it holds zero records. (It serves as a model for future projects.)

Format Files

There are four data entry format files: INSCRE1.FMT, INSCRE2.FMT, INSCRE3.FMT and INSCRE4.FMT. These input screens are called from the data entry programs INPUT.PRG, INPUTA.PRG, and INPUTC.PRG. For additional information, refer to the individual format files and data entry programs. (See Appendix A for an example of how to retrieve program source code, or consult the dBASE III PLUS manuals.)

Memory Files

ADDRMEM.MEM	(ADDRessMEMory) Contains all the memory variables necessary to run the address portion of the data entry programs, storing the input values in MASTADDR.DBF. (Every memory variable in the memory files begins with the letter "m".)
INFOMEM.MEM	(INFOrmation MEMory) Contains all the memory variables necessary to run the tank information portion of the two data entry programs.

Table 5

Fields in SOILS.DBF

Field	Type	Length	Decimal Places	Description
IREC	Numeric	5	--	Record number from U.S. Soil Conservation Service Database
CNTST	Character	60	--	County, state information. Key field that linked SOILS.DBF and MASTADDR.DBF. CNTST was a temporary field in MASTADDR.DBF used for developing the LPI value.
LINK	Character	10	--	Link to MASTINFO.DBF. Several records can have the same LINK field because there may be several soil types at a given location where a tank is buried.
PCT	Numeric	5	2	Percent
NCOMP	Numeric	1	--	Number of components or types of soil found in the county
PERM	Numeric	5	1	The permeability of the soil
PH	Numeric	3	1	The pH of the soil
SALIN	Numeric	4	1	The salinity of the soil
SWELL	Numeric	1	--	Soil shrink/swell potential
OM	Numeric	4	1	Percent of organic matter
FLOOD	Numeric	1	--	Flooding frequency for high water tables
WATERTABLE	Numeric	3	1	Depth of water
CF	Numeric	5	2	Correction factor, calculated in program CF.PRG; based on SWELL, NCOMP, FLOOD, WATERTABLE

View Files

ATOI1.VUE	(Address TO Information #1) Relates two data base files, MASTADDR.DBF and MASTINFO.DBF, using the LINK field. Both files are indexed on this key field, LINK. Thus when the record pointer moves in MASTADDR.DBF, the corresponding record pointer in MASTINFO.DBF also moves.
ITOA1.VUE	(Information TO Address #1) Relates MASTINFO.DBF and MASTADDR.DBF, using the LINK field. Both files are indexed on this key field, LINK. When the record pointer moves in MASTINFO.DBF the corresponding record pointer in MASTADDR.DBF also moves.

Index Files

Index files are used to organize data in a data base file. They were named using the convention of combining in abbreviated form the name of the data base and the field on which it is indexed. For example, MILINKTA.NDX is named for MASTINFO.DBF, indexed on the fields LINK and T_ID. The important index files and their uses are listed below. Note that many other index files may exist.

MALINK.NDX	Indexes MASTADDR.DBF on the key field LINK. It is used in both view files, ATOI1.VUE and ITOA1.VUE.
MILINKTA.NDX	Indexes MASTINFO.DBF on the key field LINK and on the tank identification field T_ID. It is used in the two view files, ITOA1.VUE and ATOI1.VUE.
MAMASTIN.NDX	Indexes MASTADDR.DBF on the fields MACOM, STATE, and INST.
MAMSTINU.NDX	Indexes MASTADDR.DBF on the fields MACOM, STATE, and INST, uniquely. Recall that several locations for a given installation were entered as separate records in MASTADDR.DBF. This index file removes any duplicate installations; it is indexed using the UNIQUE command.

Report Forms

The UST project has several report forms which use the dBASE III PLUS utility "create report". They display various aspects of the UST data and are given names such as FORM1.FRM and SUM2.FRM, where .FRM stands for "form." All the "SUM" forms display data from SUMMARY.DBF (totals of tanks in various categories) by installation and by MACOM. SUM1.FRM displays the LPI values, SUM2.FRM the age and capacity, and SUM3.FRM the material of construction and the presence of external protection. (See Appendix C for a portion of the LPI report.) These reports allow the user to customize the output. To use a .FRM file, the data base for which it was created must be open (see Appendix A or the dBASE III PLUS manuals for instructions on opening a data base). If a user creates new .FRM files he or she must keep track of what data base they are to be used with. By looking at the actual .FRM file the user can see what data will be retrieved and displayed, but the file will not show explicitly what data base it is to be extracted from. See the manuals for instructions.

Program Files

For more detail on the programs than is given here, see the documentation which is included in the program source code.

INPUT.PRG	Allows data to be appended directly to MASTADDR.DBF and MASTINFO.DBF. The data was taken from EPA Form 7530-1 (11-85).
INPUTA.PRG	Allows data to be entered onto a prepared floppy disk.
INPUTC.PRG	Is identical to the INPUTA.PRG except that the data is stored on the hard drive in two shell data base files (files that contain 0 records), ADDR.DBF and INFO.DBF.
LPI.PRG	Computes a Leak Potential Index (LPI) for each tank in the MASTINFO.DBF data base file. The LPI is computed using several parameters, such as the age of the tank and the type of soil in which it is buried, which indicate the probability of a leak in the tank (see Chapter 2). These parameters are obtained from SOILS.DBF and MASTINFO.DBF. The results of this calculation are stored in the LPI field of MASTINFO.DBF as a word ranking: VERYHIGH, HIGH, MEDIUM, LOW, VERYLOW, or NODATA, depending on where the numeric value falls within a range of allowable values. The validity of the LPI value is currently being tested. It can be used to indicate which tanks should be closely monitored, tested, or considered for replacement.
CF.PRG	Computes a value based on values from SOILS.DBF and stores this computed value in a field called CF in SOILS.DBF.
ENVIRON.PRG	A procedure file that sets up the environment when running a program. It then sets the environment back to its default status upon completion of the run. It is called from every other program, including INPUT.PRG, INPUTA.PRG, INPUTC.PRG, LPI.PRG, etc.
ADDRPROC.PRG	A procedure file that is called from INPUT.PRG, INPUTA.PRG, and INPUTC.PRG. For information on its function, see the files ADDRPROC.PRG, INPUT.PRG, INPUTA.PRG, and INPUTC.PRG.
BACKUP.PRG	Prompts the user for a data base file on the hard disk which is to be backed up on floppy disks. It will fill a floppy disk with as many records is it can from that data base file, then prompt the user to remove that floppy and insert an empty one. The data base files on the floppies are all named "BACKUP.DBF".

APPEND.PRG	Appends records from floppy disks to a data base file on the hard disk. Note that the data base file structure on the floppy must match the structure of the file on the hard disk which is being augmented. The program prompts the user for the name of the data base file to which data is being appended and asks the user to insert the floppies.

4 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

In accordance with Public Law 94-580, large amounts of data were collected on over 10,000 underground storage tanks (USTs) owned by the Army. The UST data base management system, developed by USA-CERL, facilitates the general management of this tank information using a user friendly interface and the data base capabilites of dBASE III PLUS. In addition to the information required by the law, the UST data base also contains a Leak Potential Index (LPI) for each tank. This LPI value predicts the potential of the tank leaking, based on several parameters including tank age, tank capacity, soil salinity, soil pH, etc. The LPI will provide the installations with a reference point when it becomes necessary to prioritize tanks for testing, monitoring, and replacement.

Recommendations

It is recommended that the full UST data base system be centrally located. Updates reflecting newly installed tanks, tanks with changed status, etc., would be submitted by the installation to this site, where these changes would be entered into the central data base files. Periodically, each installation would receive a copy of the UST information for the tanks which they own, including software updates, documentation, and research findings, such as the validation of the LPI. These system updates would be submitted to the installations on floppy disk.

APPENDIX A:

A SHORT INTRODUCTION TO dBASE III PLUS

Introduction

The purpose of this Appendix is to introduce the user to dBASE III PLUS, giving examples that use the UST data. It is not intended to replace the dBASE III PLUS manual. The user should learn dBASE III PLUS with the Assistant facility. The Assistant is covered in the dBASE III PLUS manual, Volume I: Learning and Using dBASE III PLUS, Chapters 1 through 7.

The remainder of this section is divided into three parts. The first part introduces DOS, dBASE III PLUS, and the Assistant. The second summarizes each of the menus available in the Assistant. The third provides examples using the UST data to illustrate the information presented in the first two sections.

Disk Operating System

DOS, Disk Operating System, is a system designed to coordinate the flow of information inside a microcomputer. It directs this information between the screen, keyboard, memory, printer, and storage disks. The user directs this flow by issuing commands to perform various tasks.

One of the major functions of DOS is its ability to organize file storage in a tree structure. This structure is best thought of as an upside-down tree with the root located at the top. This root is designated by the symbol "\", the backslash. The root can contain both files and subdirectories. Subdirectories branch down from the root and can contain more files and more subdirectories. The files in these subdirectories can be thought of as leaves in the tree because nothing more can branch down from a leaf. Hence, one has an analogy of an upside-down tree with its root at the top and its branches pointing down, where each subdirectory is a branch and each file a leaf. Each item in the tree can be specified with a pathname, allowing movement throughout.

Below is an example of a tree with the root, "\", that contains one file, CONFIG.SYS, and two subdirectories, DBASE and WORDSTAR. The dBASE directory contains two files, MASTADDR.DBF and DBASE.COM. The WORDSTAR directory contains three files, FILE1, FILE2, and FILE3. The pathname for FILE1 starting from the root, is "\WORDSTAR\FILE1". (File and directory names do not have to be capitalized; however, they are capitalized here for clarity.)

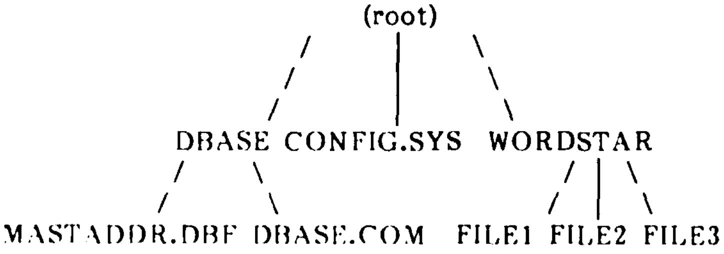

Figure 1. DOS Tree Structure

Another important DOS concept is the wild card character, "*", the asterisk. It is used whenever it is desirable to refer to all files whose name contains a certain pattern of letters. Any valid characters can be in the positions of the wild card character. For example, "*.dbf" includes all files whose name ends in ".dbf" such as MASTADDR.DBF and SOILS.DBF but not INPUTA.PRG. Similarly "w*.*" would include the files WS.OVR and WS.DOC but not SW.DOC.

To perform DOS operations, the user issues "commands." Several of the more common DOS commands are discussed below in a condensed form. The DOS manual gives complete explanations and additional commands. Below, a word enclosed in brackets indicates that the actual name of the file should be used, without the brackets.

DIR

Purpose: The DIR command (DIRectory) displays all the files in the specified directory.

Syntax: DIR [pathname]

Comments: If only DIR is entered, all the files are displayed. Wild card characters can be used.

Examples: DIR - displays all files in the current directory
DIR *.DBF - displays all files with the .dbf extension
DIR W*.* - displays all files whose names begin with "w"

MKDIR

Purpose: The MKDIR command (MaKe DIRectory) creates a new subdirectory below the current directory.

Syntax: MKDIR [directory name]

Comments: Use MKDIR to create the tree structure that organizes and categorizes the files on a hard drive.

Examples: MKDIR dbase - makes a subdirectory called "DBASE" to store files created using dBASE III PLUS
MKDIR ws - makes a subdirectory called "WS" to store WordStar* files

CD

Purpose: The CD command (Change Directory) allows movement in the tree structure that was created with the MKDIR command.

Syntax: CD [pathname]

Comments: A "\" means move down the tree to a directory immediately below the current one. A ".." is another way of naming the directory immediately above the current one.

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*WordStar is a trademark of Microsoft.

Examples: CD \dBASE - move down from the current directory to the dBASE directory (immediately below current one)
CD .. - move up to the directory above the current directory
CD \ - return to the root from any location in the tree

COPY

Purpose: The COPY command copies one or more files to another location.
Syntax: COPY [source pathname] [destination pathname]

Comments: A drive letter should always be specified when copying from the hard disk to a floppy disk and vice versa. The practice will help prevent errors and loss of data. The wild card character may be used.

Examples: COPY c:INPUTA.PRG a:INPUTA.PRG
- copy the file INPUTA.PRG from the hard drive (c:) to a floppy disk (a:) with the name for the file on the floppy the same as the original

COPY a:MYCONFIG.DB c:CONFIG.DB
- copy the file MYCONFIG.DB from the floppy disk to the hard disk calling the file on the hard disk CONFIG.DB

COPY a:*.* c:
- copy all the files from the floppy disk to the hard drive, all with the original names

dBASE III PLUS

dBASE III PLUS is a software package that helps collect and manage information and data. Data is stored in a data base file where it can be organized, displayed, changed, found, analyzed, related, and printed. The rest of this Appendix will discuss these facilities and how to use them with the UST data. It is assumed that dBASE III PLUS has been installed on the hard disk and the UST project files (see Appendix B) have been copied to the hard disk as well.

There are several different file types used to manipulate the data in the data base files. Note that these files are not for editing the data but for manipulating and presenting it in different ways. The last four, data base memo files through text files, are useful but less important.

Catalog	Catalog (.CAT) files contain a group of files that all pertain to a specific project.
Database	Database (.DBF) files store data in records (rows) and fields (columns).
Index	Index (.NDX) files provide the means to organize a data base file alphabetically, chronologically, or numerically. An index file will not change the physical locations of the records in the data base file; the ordering is for presentation of the data only. Note: It is preferable to "index" a file rather than "sort" it.

Query	A query (.QRY) file contains a filter condition that restricts the records which will be included in some task.
Report	Report (.FRM - stands for "form") files are used to create report forms for displaying the data in a data base file and directing it to the printer.
View	View (.VUE) files provide the facility to link together two or more data base files which have a common field. Filters (using the query files) and indexes (using the index files) can be included in the relation.
Format	Format (.FMT) files create custom screen forms for use in entering data. Format files can be created from screen (.SCR) files or from commands put into an ASCII text file with a word processor and stored in format files (.FMT).
Screen	Screen (.SCR) files contain information that is used to generate and modify format (.FMT) files.
Command/ Program	Command and program (.PRG) files contain dBASE III PLUS commands that have been stored as a program. They are ASCII files that, when executed, perform some task using the other dBASE III PLUS files.
Database Memo	Database Memo (.DBT) files are used in conjunction with data base files that contain a memo field. All memos in the data base file are stored in its corresponding data base memo file.
Label	Label (.LBL) files print labels for mailing purposes.
Memory	Memory (.MDM) files contain memory variables used in a program (.PRG) file. These memory variables are saved in a memory file to be used at a later time.
Text	Text (.TXT) output files are primarily used to interface dBASE III PLUS with other software that reads ASCII files.

The Assistant

The Assistant is a full screen, menu driven facility that prompts the user through many dBASE III PLUS commands, allowing the user to manipulate the data in a variety of ways. It is automatically available when dBASE III PLUS is started, but there are other situations when it can be used as a command (see the dBASE III PLUS manuals). As a menu driven system, the Assistant represents a hierarchy of options. The first level of menus displays options that are of a broad, general nature. After you make a selection, the Assistant presents you with a new set of more specific options to accomplish a more specific task. There are three ways to move through the Assistant menus:

Arrow Keys	Used to move the highlighted area around the menu
Return Key	Used to select the option that is currently high-lighted
Escape Key	Used to cancel a selection and display the previous menu.

Details of Assistant Menus

Main Menu

The main menu is organized around the major tasks that can be performed on data. A brief description follows of each main menu option and the jobs it will perform.

Set Up	Set up the environment to work with. This menu is the starting point for all operations on the data in existing data base files.
Create	Create new files. Files are of different types, performing different functions as described earlier.
Update	Edit the data in the data base file that was chosen with the "Set Up" option.
Position	Move the record pointer to a specific location in the currently open data base file.
Retrieve	Extract some part of the information in the current data base file, to be directed to the screen or the printer.
Organize	Organize the data in the current data base file in some specific arrangement.
Modify	Edit a file that was previously created for the purpose of manipulating the data in a data base file. This differs from the "Update" option, which allows the user to edit the actual data. "Modify" allows the user to change the way this data is manipulated.
Tools	Choose external options that are similar to DOS commands (ie., the "Directory" option is the same as the DOS "dir" command).

Set Up Sub-Menu

Use this menu to set up the environment to begin manipulation of the data in the data base files. The following options appear on the menu.

Database file	A data base file must first be opened before anything at all can be done with the data stored there. This option will present a list of data base files to work with.
Format for Screen	Choose a previously created screen design that presents areas for entering the data for a data base file when APPENDing or EDITing this data.
Query	Choose a previously created query (filter) file so that only the records that meet certain conditions are included in future operations on the data in this data base file.
Catalog	Choose a previously created catalog to include all the files relating to a project so that a description of each of the files in the project will be presented.

View	Choose a previously created view file that will link two or more data base files together on a key field that they have in common.
Quit	Exit the dBASE III PLUS software and return to DOS.

Create Submenu

Use this menu to create new files to manipulate the data in the data base files.

Database file	Create a new structure for a new data base file. This includes defining the names, types, and lengths of the fields.
Format	Create a new screen design with a "blackboard" to present the data in a data base file on the screen.
View	Create a new view file, a relation that links two or more data base files together by a key field they have in common.
Query	Create a new query file, a filter condition to access only records in the current data base file that meet a certain requirement.
Report	Create a new report layout to print the data in the current data base files.
Label	Create mailing address labels.

Update Submenu

Use this menu to edit the data in the currently open data base file.

Append	Add new records to the bottom of the current data base file.
Edit	Edit the records of the current data base file. One record is presented on the screen at a time to be edited.
Display	Show the data in the current record in the current data base file. Specific fields may be indicated.
Browse	Edit the records of the current data base file. Several records are presented on the screen at a time.
Replace	*CAUTION* Replace the contents of a specific field of the current data base file with new values.
Delete	Mark records in the current data base file for deletion. The marked records are still visible and retrievable even after this "delete" is done.

Recall	Retrieve records that have been marked for deletion with the "delete" command.
Pack	*CAUTION* Permanently remove records that were marked for deletion with the "delete" command.

Position Submenu

Use this menu to move the record pointer in the current data base file to a new location, pointing to a different record.

Seek	Conducts a very rapid search in an indexed data base file on a key field that matches a specific expression in that key field.
Locate	Locate in an indexed or nonindexed data base file on a field for a specific expression. Note that this command is used with the "continue" command.
Continue	Continue to "locate", finding the next record that meets the locate condition. Note that this command cannot be used unless a "locate" command was issued just before it.
Skip	Move the record pointer forward or backwards in the current data base file. Enter a positive integer for forward movement, negative for backwards. For example, highlighting "Skip" and entering "-10" will move the pointer backwards 10 records.
Goto Record	Move the record pointer to a specific record number in the current data base file.

Retrieve Submenu

Use this menu to display or print records in groups that meet certain conditions.

List	List (scroll) the records in the current data base file. Note that it is usually necessary to specify which fields are to be listed. Otherwise, the limited width of the screen or printer will cause the record to be listed on multiple lines.
Display	Similar to "list" except the scrolling pauses when the screen has filled with records.
Report	Use a previously created report form to direct the data to the printer or the screen.
Label	Use a previously created label format to print mailing labels.
Sum	Total specified numeric fields in the current data base file.

Average	Compute the average for specified numeric fields in the current data base file.
Count	Count (tally) the number of records in the current data base file that meet a certain criteria.

Organize Submenu

Use this menu to order the records in the current data base file to meet specific criteria.

Index	Creates an index file to access records in a specified order: arranges the records in the current data base file alphabetically, chronologically, or numerically. This ordering is not a physical movement of the records: the original data base file is not altered. *NOTE* Indexing is recommended instead of sorting, although there are a few situations which require sorting.
Sort	Works like "index" except the records are physically moved and copied in the new order to a new data base file. *Note* The preferred command is "index". Sorting is not advised except in extreme cases since sorting copies the entire data base file, occupying additional disk space.
Copy	Copy all or part of the active data base file to a new file. Specific fields and/or records may be copied.

Modify Submenu

Use this menu to modify a previously created file that manipulates the data in a data base file. (For a complete description of the different types of files, see explanation above.)

Database file	Modify the structure of the data base file currently in use by changing the names, widths, and types of the fields.
Format	Modify a previously created format file, a screen design for presenting the data base file structure on the screen.
View	Modify a previously created view file, a relational file to link two or more data base files together using a field they have in common.
Query	Modify a previously created query file, a filter to specify records that meet a specific criteria.
Report	Modify a previously created report file, a file to present data in the current data base file in a manner suitable for printing.
Label	Modify a previously created label file, a file to print mailing labels.

Tools Submenu

Use this submenu to perform external options to manipulate entire files, rather than manipulate the data inside the current data base file.

Set drive	Change the drive to have access to files on a different disk.
Copy file	Make a duplicate of any type of file.
Directory	List the files in the current directory. This is similar to the DOS "dir" command.
Rename	Rename a file of any type.
Erase	*CAUTION* Remove an entire file of any type.
List structure	List the field names, widths, and types of the fields in the current data base file.
Import	Bring a non-dBASE III PLUS file into dBASE III PLUS.
Export	Send a dBASE III PLUS file out to a non-dBASE III Plus file (PFS) Personal Filing System.

Accessing dBASE III PLUS

The following instructions will lead you to the point where you will be dBASE III PLUS and can begin manipulating the UST data. These instructions assume that all the files for executing dBASE III PLUS are located in a subdirectory DBASE, below the root. (See Appendix B for a list of the UST files.) All the UST files should also be in this directory. If these sets of files are not there, use the DOS commands explained in the previous section to copy them to the DBASE directory.

1. Begin at the root directory. This is where the system will be immediatly after the machine is turned on. At the system prompt, type

   ```
   cd dbase
   ```

   This commands the computer to change directories down the tree structure, moving into the DBASE subdirectory. This is where all the dBASE III PLUS and UST files are located. (Either capital or lower case letters can be used for these commands.)

2. Next, at the prompt, type

   ```
   dbase
   ```

   This command initiates use of the dBASE III PLUS software.

3. The screen will now display a dBASE III PLUS copyright screen. Next, you will see a screen of menu options. This is the Assistant, the facility for manipulating data.

4. You are now ready to work with the UST data.

Help

There are two on-line sources of information.

Screen	The best source of information is right on the screen. Always be aware of the information displayed at the bottom of the screen. There, you can find the active data base file, the number of records in the current data base file, the current record in the data base file, and the command that is being created using the Assistant. In addition, directions for moving around in the menu and menu option explainations are given. Recognizing that this information is available will allow you to familiarize yourself with the many facilities available in dBASE III PLUS.
F1 Key	Any time you would like more information about an option, hit the F1 function key to read an explanation of how it can be used.

The dBASE III PLUS manual is also a source of help, of course. There are two sections that will be especially useful. In Volume I, Section 1, "Learning dBASE III PLUS" (Chapters 1 through 7), you will find a detailed explanation of the use of the Assistant. Volume I, Section 2, "Using dBASE III PLUS" (Chapter 5) gives a listing of all the commands that are used in the dBASE software.

Examples

To review the previous discussion, this set of examples will show you ways of using several basic but important dBASE III PLUS facilities to look at the UST data. It is suggested that you also become familiar with the "Query" and "Report" facilities. These and other operations are slightly more complicated, but prove to be very useful when mastered.

Example 1: Opening a Data Base File

In this example, you will learn a procedure that is used each time a new data base file is selected. You will set up the environment so that you can begin working with the data stored in the data base file. But before you can use the information in any data base file, you must first activate the file by opening it for use. This is important: you will not be able to see, print, organize, or edit any data in a data base file until that file has been opened. The basic steps are: (1) enter dBASE, (2) open the UST.CAT catalog, and (3) activate the data base file.

1. Enter dBASE III PLUS

   a. Start from the root directory. (These instructions assume that all dBASE III PLUS software and UST files are in the dBASE subdirectory.)

   b. At the prompt, type

      ```
      cd dbase
      ```

c. At the next prompt, type

dbase

d. The dBASE III PLUS copyright screen appears. It is then replaced with the Assistant menu.

2. Select the "Catalog" option

   a. ALWAYS read the description of the commands on the bottom of the screen. This can not be overemphasized.

   b. Use the arrow keys to position the highlighted area over the "Catalog" option, then press the Return key.

   c. A second menu appears which displays available drive letters. Choose c: to designate the c drive by using the arrow keys to position the highlighted area over c:, then press the Return key.

   d. A third menu appears which displays the catalogs available to choose from. Select UST.CAT by using the arrow keys to position the highlighted area over UST.CAT, then press the Return key.

3. Select the "Database file" option

   a. ALWAYS read the description of the commands on the bottom of the screen! Again, this is very important.

   b. Use the arrow keys to position the highlighted area over the "Database file" option, then press the Return key.

   c. A second menu appears which displays a list of data base files from which to choose. As you move up and down the list of data base files, notice that a description for each is given below in a separate box. Suppose you want to view addresses of tank locations.

   d. Select MASTADDR.DBF (MASTer ADDRess) by using the arrow keys to position the highlighted area over MASTADDR.DBF then press the Return key.

   e. A question appears: "Is this data base file indexed? (y/n)". This means, more accurately, "Is there an existing index that you want to use to order this data base file?" Answer "n" to this question, since you will make your own in a later example.

   f. After the answer "n" is given, the "Database file" option is again highlighted. Now we are ready to work with the data in the data base file MASTADDR.DBF. Notice at the bottom of the screen, the word "MASTADDR" appears. This tells you that you can now use the information stored in the MASTADDR.DBF data base file. Also notice the item "REC: 1/####". This indicates that the record currently being accessed is the first in the file and that there are #### total records in the file.

Example 2: Looking at Data

In Example 1, you opened the MASTADDR.DBF data base file. You know it is open and the data can be manipulated because you see at the bottom of the screen the word **"MASTADDR"**. In Example 2, you will continue by looking at the data stored there. There are several different commands for viewing the data stored in a data base file; you will investigate the "List" option, from the "Retrieve" menu.

Note: If you are not in directory DBASE with the MASTADDR.DBF data base file open, begin with Example 1.

1. Select the "List" option.

   From the "Retrieve" menu, use the arrow keys and the Return key to select the "List" option by hitting the return key. Notice that "Command: LIST" appears at the bottom of your screen.

2. Constructing a field list

   a. You are immediately presented with another menu, the first option being "Execute the command". From this menu, you will specify which fields you want to look at from the MASTADDR.DBF data base file. This is necessary because when all the fields are placed side by side, they are wider than the width of the screen. Use the arrow keys and Return key to select the "Construct a field list" option.

   b. You are immediately presented with two more menus. The one on the left is a list of all the fields in the active data base file, MASTADDR.DBF. The box in the very center of the screen is a description of the field that is currently highlighted. Use the arrow keys to move the highlighted area up and down the field list as you observe the description of the field in the box in the center.

   c. Now you will choose some fields to include in a listing. To choose a field, hit Return key when the highlighted area is over the field. The first field we will include is MACOM (MAjor COMmand). Press Return key when the highlighted area is over this field. In the field list, MACOM is now a different color than the others, indicating that is has been selected. Notice this field name is displayed at the bottom of the screen, which now reads "Command: LIST MACOM".

   d. Likewise, use the arrow keys to select the INST field and the STATE field. Again, notice the command at the bottom of the screen which reads "Command: LIST MACOM, INST, STATE".

   e. Use the right or left arrow key to exit the fields list.

3. Stop a process (like LIST)

   Before continuing with the example, observe that the data base file is very long. This can be seen by the "REC: 1/####" at the bottom of the screen, indicating that there are #### records in this particular data base file. After executing the "List" command, you will not want to wait while all of the records scroll across your screen; that would take too long. The listing can be stopped by hitting the Escape key, at which time a message on the bottom of the screen will instruct you to "Press any key to continue working in ASSIST".

4. Execute the command

   You will now list on the screen the fields that we have just specified. Then, when you have seen enough of the listing scroll by, you will stop the process by hitting the Escape key and return to the Assistant menu.

   a. Choose the "Execute the command" option. This means, "Execute the command that is at the bottom of the screen."

   b. When asked, "Direct the output to the printer? [Y/N]", answer "n".

   c. After several screens of records have scrolled by, hit the Escape key to stop the scrolling.

   d. Hit any key to return to the Assistant, as the instruction at the bottom of the screen tells you to do.

5. *Build a search condition*

   So far in Example 2 you have activated MASTADDR.DBF and specified three of the fields from this data base file for listing. Recall that the reason you specified only three fields is because the width of an entire individual record is too wide to fit across the screen. Now, you will list only the records that meet a certain condition. Suppose you only want to see records containing Illinois addresses.

   a. Select the "List" option and "Construct a field list" as in steps 1 through 3 above.

   b. After completing the "Construct a field list" option, choose the "Build a search condition" option since you want to search for records only for the state of Illinois.

   c. Choose the STATE field from the field list presented, since we will be matching only for the state of Illinois.

   d. Choose the "= Equal To" option from the list of conditional operators since we would like to see only the records for which the STATE field exactly matches Illinois.

   e. Enter 'IL' in CAPITAL letters. NOTE THAT ALL INFORMATION IS STORED IN CAPITAL LETTERS.

   f. Choose the "No more conditions" option from the list.

   g. Notice the command at the bottom of the screen. It should read "Command: LIST MACOM, INST, STATE FOR STATE = 'IL'". In English this means, "List the information in the MACOM, INST, and STATE fields for all the records in the state of Illinois."

   h. Choose the "Execute the Command" option.

i. Do not direct the output to the printer.

j. Notice that as the information lists on your screen that all the records are from the state of Illinois, just as you specified. Notice that the scrolling may pause at times. This is because the system is searching through all the records looking for STATE = 'IL' as specified. Stop the scrolling by hitting the Escape key.

Example 3: Organizing the Data

In the two preceding examples, you have seen how to open a data base file so you can work with the information inside it. You also learned how to list the information that meets specified criteria to the screen or printer. Next you will learn to organize this information. In this example you will list the data alphabetically. This is accomplished using the "Index" option from the "Organize" menu.

You will organize the data in the MASTADDR.DBF by the STATE field. Then we will list some of the fields to the screen to verify that the records are in alphabetical order according to this STATE field.

1. Enter dBASE III PLUS and open the MASTADDR.DBF data base file exactly as in Example 1, if you haven't already done so.

2. From the "Organize" menu, choose the "Index" option.

3. A box will appear, asking you to "Enter an index key expression:" .This is prompting you to enter the field you would like to use to index the information in this data base; that is, how do you want the information organized? Notice at the bottom of your screen a line that reads, "F10 for a field menu". (ALWAYS read the bottom of your screen.) Press the F10 key to see a list of the fields in MASTADDR.DBF.

4. Again, the list of all fields in the MASTADDR.DBF will appear. Choose the STATE field since this is the field you will use to organize records. STATE is now entered in the highlighted block. Press the Return key. Notice the command at the bottom of your screen.

5. Next, you are asked to name the new index file that you are in the process of creating. The name you choose should convey information about which database file this index is associated with and how the file is indexed. Therefore, enter MASTATE.NDX to indicate the MastAddr.dbf and the STATE field. Press the Return key.

6. Wait several seconds while the computer rearranges the records, putting them in alphabetical order by the STATE field. "Press any key to continue working in ASSIST" when prompted to do so.

7. The main menu will reappear. Now you will want to verify that the records are indeed in alphabetical order according to the STATE field.

8. From the "Retrieve" menu, choose the "List" option as in Example 2. Construct a field list of the MACOM, INST, and STATE fields. Notice as the records list that they are alphabetized by the STATE field.

Example 4: Looking at Organized Data

The index file, MASTATE.NDX that was created in Example 3 is now available for future use. Now you will exit dBASE III PLUS and return to DOS. Then you will re-enter the directory dBASE, open the MASTADDR.DBF and use the index file you created in Example 3.

1. Exit dBASE III PLUS by going to the "Set Up" menu and choosing the "Quit dBASE III PLUS" option. You will now be at the DOS prompt.

2. Reenter dBASE III PLUS by typing dBase. As in Example 1, open the UST catalog, then use the MASTADDR database file. When you are asked, "Is this data base file indexed? [Y/N]", answer "y". You will be presented with a list of index files, including the one you created in Example 3, MASTATE.NDX. You will also see another box with a description of how each index file is organized. The MASTATE.NDX file that was created in Example 3 was indexed on the STATE field which is displayed in the third box.

3. Upon choosing the MASTATE.NDX file, the word "MASTER" appears next to it. This is to indicate that several indexes may be used at the same time, with one being the dominant index which has precedence over all others. Simply use the left/right arrow keys to exit this menu since you will not specify more than the MASTATE.NDX file.

4. The main menu will reappear. Select the "List" option as in Example 2 and view the data, noticing that it is again alphabetized by the MACOM field.

Example 5: Searching on a Coded Field

Several of the fields in MASTINFO.DBF are coded, as shown in Table 3 in Chapter 2. Since a search will be successful only if an EXACT match is made with the information stored in the field being searched, please refer to that table for a complete listing of these codes and their formats.

In this example you will search for all the tanks in MASTINFO.DBF that contain gasoline. This information is stored in the coded PETRO field in MASTINFO.DBF.

1. Begin dBASE III PLUS as in Example 1, *except instead of opening* MASTADDR.DBF, open MASTINFO.DBF. This is the file where all the detailed tank information is stored. You may answer "n" to "Is this file indexed?"

2. As in Example 2, from the Retrieve menu, select the "List" option. Select the "Construct a field list" option as in Example 2, choosing fields LPI, STATUS, YEAR, CAPACITY, and PETRO. Notice the command located on the bottom of your screen.

3. As in Example 2, next choose the "Execute the command" option. As the listing scrolls across the screen, notice that the PETRO field contains values such as " K" or " G", for example. Notice their respective placements in the PETRO field. This is an illustration of the coded information where the "K" stands for "Kerosene" and "G" stands for "Gasoline". Press the Escape key to stop the scrolling, then hit any key to continue working in the Assistant.

4. Now you will specify that you only wish to list the tanks that contain gasoline.

   a. Once you are back in the Assistant, again choose the "List" option from the Retrieve menu. Next choose "Construct a field list" as before, specifying the LPI, STATUS, YEAR, CAPACITY, AND PETRO fields.

   b. Upon returning to the List menu, choose the "Build a search condition" option. Two new boxes will appear, one displaying the fields in MASTINFO.DBF, another showing the specifics of the individual fields currently highlighted.

   c. With the arrow keys, move down the fields list until the highlighted area covers the PETRO field. Hit the Return key.

   d. A new menu appears, with a message at the bottom of the screen prompting you to "Select a logical operator for the FOR clause". Remember, ALWAYS read the bottom of the screen. Choose the " = Equal To" option.

   e. Another box appears instructing you to "Enter a character string (without quotes):". You will now specify the coded information. We wish to specify only the tanks containing gasoline. As indicated in Table 3 in Chapter 2, the third space in the field is reserved for a capital G for gasoline. So, in the highlighted box, strike the spacebar twice, then type the CAPITAL letter G. That is, hit the following keys:

      <spacebar> <spacebar> G

      The position of the code in the field is important because the correct number of spaces must be used. Otherwise, an exact match will not be found. Hit the return key.

   f. Notice that the bottom of the screen reads: "Command: LIST LPI, STATUS, YEAR, CAPACITY, PETRO FOR PETRO = ' G' ".

   g. Another menu will appear. Choose the "No more conditions" option.

   h. Back at the List menu, choose the "Execute the command" option, answering "n" to the question asking if the output should be directed to the printer.

   i. As the listing scrolls across the screen, notice that only tanks containing gasoline are displayed as indicated by the " G" in the PETRO field.

   j. As always, hit the Escape key to stop the scrolling, then any key to return to the Assistant.

Example 6: Retrieving Program Listings

You may need to look at the program files, that is, files that end with the .PRG extension. This example explains how to get a listing of the source code for these programs and how to print out that listing. We will use the program BACKUP.PRG to demonstrate the steps in obtaining the printout. The purpose of BACKUP.PRG is to backup a specified data base file on the hard disk to floppy disks.

1. Enter dBASE III PLUS as in Example 1.

2. At the main menu, hit the Escape key. This will get you out of the Assistant and clear the screen. The new screen will have the status line displayed at the bottom, with a dot prompt above it in the lower left hand corner. This situation is called the "command mode," which means that all commands are to be typed at the dot prompt. Recall that in the Assistant each time a menu choice was selected a command appeared at the bottom of the screen. Those commands can be typed here, as well as commands and facilities that cannot be used in the Assistant.

3. At this prompt, type

   ```
   type backup.prg
   ```

   The program called BACKUP.PRG will scroll across the screen.

4. To obtain a printout of the program BACKUP.PRG, be sure your printer is ready, then type

   ```
   type backup.prg to print
   ```

5. After the program BACKUP.PRG is finished printing, the dot prompt will reappear. To return to the Assistant, type

   ```
   assist
   ```

   or press the F2 function key.

6. The Assistant main menu will reappear.

7. Exit dBASEIII PLUS by choosing "Quit dBASE III PLUS" from the "Set Up" menu.

Points to Remember

Several points should be kept in mind when working with the UST data and dBASE III PLUS.

- A data base file must be opened (Example 1) before ANYTHING can be done with that file or the data stored in it.

- ALWAYS read the information displayed at the bottom of the screen. This is the best source of helpful information when learning dBASE III PLUS.

- All information stored in the UST data base files is in CAPITAL LETTERS. Lower case letters are distinguishable from upper case letters.

- A file to manipulate the data in a data base file must be created before it can be used. (In Example 3, an index file, MACOM.NDX, was created.)

- If more assistance is needed than the screen and manuals can provide, Ashton-Tate, the maker of dBASE III PLUS, offers technical support (for a fee). Current phone numbers as of the date of this document are:

  Headquarters: (213) 329-8000

  Technical Support: (213) 329-0086

  Sales: (213) 329-7241.

APPENDIX B:

LIST OF UST FILES

ADDR.DBF
ADDRMEM.MEM
ADDRPROC.PRG
APPEND.PRG
ATOI1.VUE
BACKUP.PRG
CF.PRG
ENVIRON.PRG
FORM1.FRM
FORM2.FRM
FORM3.FRM
INFO.DBF
INFOMEM.MEM
INPT.PRG
INPUTA.PRG
INPUTC.PRG
INSCRE1.FMT
INSCRE2.FMT
INSCRE3.FMT
INSCRE4.FMT
INSTALLA.DBF
ITOA1.VUE
LEAK.DBF
LPI.PRG
MALINK.NDX
MAMASTIN.NDX
MAMSTINU.NDX
MASTADDR.DBF
MASTINFO.DBF
MILINKTA.NDX
SOILS.DBF
STATE.DBF
SUMMARY.DBF
SUM1.FRM
SUM2.FRM
SUM3.FRM
UST.CAT

APPENDIX C:

SAMPLE REPORT FORM

```
Page No. ...............................................................1
04/28/87
               **** INSTALLATION TANK STATISTICS REPORT #1 ****
                           LEAK POTENTIAL INDEX

                                                 ** LPI **
                                 NUM   VERY                    VERY NO
     INSTALLATION            ST  TANKS HIGH  HIGH  MED  LOW  LOW  DATA
**************************   **  ***** ****  ****  ***  ***  **** ****


**  AMC - AMCCOM
 ALABAMA AAP                 AL *      *      *     *    *    *     *
 PINE BLUFF ARSENAL          AR
 RIVERBANK AAP               CA
 ROCKY MOUNTAIN ARSENAL      CO
 JOLIET AAP                  IL
 ROCK ISLAND ARSENAL         IL
 INDIANA AAP                 IN
 NEWPORT AAP                 IN
 KANSAS AAP                  KS
 SUNFLOWER AAP               KS
 LOUISIANA AAP               LA
 TWIN CITIES AAP             MN
 LAKE CITY AAP               MO
 MISSISSIPPA AAP             MS
 CORNHUSKER AAP              NE
 HAWTHORNE AP                NV
 WATERVILET ARSENAL          NY
 MCALESTER AAP               OK
 SCRANTON AAP                PA
 HOLSTON                     TN
 MILAN AAP                   TN
 VOLUNTEER AAP               TN
 LONE STAR AAP               TX
 LONGHORN AAP                TX
 RADFORD AAP                 VA
 BADGER AAP                  WI
** Subtotal **


** AMC - ARRADCOM
 ARMAMENT RES & DEV          NJ
 CENTER
 PICATINNY ARSENAL           NJ
** Subtotal **


** AMC -AVSCOM **
 ST LOUIS AREA SUPPORT       IL
 CENTER
 ST LOUIS AVIATION SYSTEMS   MO
 COMM
 MATERIALS, DEVELOPMENT, &   VA
 READ
** Subtotal **
```

---

*In an actual report, this column would show the number of tanks at this installation which fall in this category.

Appendix D:

EPA Form 7530-1 (11-85)

On the following pages is a copy of EPA Form 7530-1 (11-85). It shows the data field in the UST system that corresponds to each blank on the form. For coded fields the initial letters that were used as the codes are indicated.

Notification for Underground Storage Tanks

FORM APPROVED
OMB NO. 2050-0068
APPROVAL EXPIRES 6-30-88

STATE USE ONLY

I.D. Number

Date Received

GENERAL INFORMATION

Notification is required by Federal law for all underground tanks that have been used to store regulated substances since January 1, 1974, that are in the ground as of May 8, 1986, or that are brought into use after May 8, 1986. The information requested is required by Section 9002 of the Resource Conservation and Recovery Act, (RCRA), as amended.

[illegible] purpose [illegible] program [illegible] underground tanks that [illegible] petroleum [illegible] hazardous substances. [illegible] expected that the information [illegible] will be based on [illegible] available records, or, in the absence of such records, your knowledge [illegible] recollection.

Who Must Notify? Section 9002 of RCRA, as amended, requires that, unless exempted, owners of underground tanks that store regulated substances must notify designated State or local agencies of the existence of their tanks. Owner means— (a) in the case of an underground storage tank in use on November 8, 1984, or brought into use after that date, any person who owns an underground storage tank used for the storage, use, or dispensing of regulated substances, and (b) in the case of any underground storage tank in use before November 8, 1984, but no longer in use on that date, any person who owned such tank immediately before the discontinuation of its use.

What Tanks Are Included? Underground storage tank is defined as any one or combination of tanks that (1) is used to contain an accumulation of "regulated substances," and (2) whose volume (including connected underground piping) is 10% or more beneath the ground. Some examples are underground tanks storing: 1. gasoline, used oil, or diesel fuel, and 2. industrial solvents, pesticides, herbicides or fumigants.

What Tanks Are Excluded? Tanks removed from the ground are not subject to notification. Other tanks excluded from notification are:

1. farm or residential tanks of 1,100 gallons or less capacity used for storing motor fuel for noncommercial purposes;
2. tanks used for storing heating oil for consumptive use on the premises where stored;
3. septic tanks;
4. pipeline facilities (including gathering lines) regulated under the Natural Gas Pipeline Safety Act of 1968, or the Hazardous Liquid Pipeline Safety Act of 1979, or which is an intrastate pipeline facility regulated under State laws;
5. surface impoundments, pits, ponds, or lagoons;
6. storm water or waste water collection systems;
7. flow-through process tanks;
8. liquid traps or associated gathering lines [illegible] gathering operations;
9. storage tanks [illegible] mineworking, drift, shaft, or tunnel) [illegible] surface of the floor.

What Substances Are Covered? [illegible] underground storage tanks that contain regulated [illegible] defined as hazardous in section 101(14) of the [illegible] Response, Compensation and Liability Act of 1980 (CERCLA) [illegible] those substances regulated as hazardous waste under Subtitle C [illegible] includes petroleum, e.g., crude oil [illegible] conditions of temperature and pressure (60 degrees Fahrenheit [illegible] square inch absolute).

Where To Notify? Completed notification [illegible] given at the top of this page.

When To Notify? 1. Owners of underground storage tanks [illegible] taken out of operation after January 1, 1974, but [illegible] May 8, 1986. 2. Owners who bring underground storage tanks [illegible] 1986, must notify within 30 days of bringing the tanks into use.

Penalties: Any owner who knowingly fails to notify or submits false information shall be subject to a civil penalty not to exceed $10,000 for each tank for which notification is not given or for which false information is submitted.

INSTRUCTIONS

Please type or print in ink all items except "signature" in Section V. ***This form must by completed for* each location containing underground storage tanks.** If more than 5 tanks are owned at this location, photocopy the reverse side, and staple continuation sheets to this form.

Indicate number of continuation sheets attached ☐

I. OWNERSHIP OF TANK(S)

Owner Name (Corporation, Individual, Public Agency, or Other Entity)
INST

Street Address

County

City | State STATE | ZIP Code ZIP

Area Code | Phone Number

Type of Owner (*Mark all that apply* ☒)

☐ Current
☐ Former
☐ State or Local Gov't
☐ Federal Gov't (GSA facility I.D. no. ________)
☐ Private or Corporate
☐ Ownership uncertain

II. LOCATION OF TANK(S)

(If same as Section 1, mark box here ☐)

Facility Name or Company Site Identifier, as applicable
LOC_NAME

Street Address or State Road, as applicable
LOC_STREET

County
LOC_COUNTY

City (nearest) LOC_CITY | State LOC_STATE | ZIP Code LOC_ZIP

Indicate number of tanks at this location: LOC_NUM_T ☒

Mark box here if tank(s) are located on land within an Indian reservation or on other Indian trust lands ☐

III. CONTACT PERSON AT TANK LOCATION

Name (If same as Section I, mark box here ☐) | Job Title | Area Code | Phone Number

IV. TYPE OF NOTIFICATION

☐ Mark box here only if this is an amended or subsequent notification for this location.

V. CERTIFICATION (Read and sign after completing Section VI.)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete.

Name and official title of owner or owner's authorized representative	Signature	Date Signed

CONTINUE ON REVERSE SIDE

EPA Form 7530-1 (11-85)

Owner Name (from Section I) ____________ Location (from Section II) ____________ Page No. ____ of ____ Pages

VI. DESCRIPTION OF UNDERGROUND STORAGE TANKS (Complete for each tank at this location.)

Tank Identification No. (e.g., ABC-123), or Arbitrarily Assigned Sequential Number (e.g., 1,2,3...)	**Tank No.** TANKNAME	**Tank No.**	**Tank No.**	**Tank No.**	**Tank No.**
1. Status of Tank *(Mark all that apply ☒)* STATUS — Currently in Use	☐	☐	☐	☐	☐
Temporarily Out of Use	☐	☐	☐	☐	☐
Permanently Out of Use	☐	☐	☐	☐	☐
Brought into Use after 5/8/86	☐	☐	☐	☐	☐
2. Estimated Age (Years) YEAR					
3. Estimated Total Capacity (Gallons) CAPACITY					
4. Material of Construction *(Mark one ☒)* MATERIAL — Steel	☐	☐	☐	☐	☐
Concrete	☐	☐	☐	☐	☐
Fiberglass Reinforced Plastic	☐	☐	☐	☐	☐
Unknown	☐	☐	☐	☐	☐
Other, Please Specify					
5. Internal Protection *(Mark all that apply ☒)* INTERNPROT — Cathodic Protection	☐	☐	☐	☐	☐
Interior Lining (e.g., epoxy resins)	☐	☐	☐	☐	☐
None	☐	☐	☐	☐	☐
Unknown	☐	☐	☐	☐	☐
Other, Please Specify					
6. External Protection *(Mark all that apply ☒)* EXTERNPROT — Cathodic Protection	☐	☐	☐	☐	☐
Painted (e.g., asphaltic)	☐	☐	☐	☐	☐
Fiberglass Reinforced Plastic Coated	☐	☐	☐	☐	☐
None	☐	☐	☐	☐	☐
Unknown	☐	☐	☐	☐	☐
Other, Please Specify					
7. Piping *(Mark all that apply ☒)* PIPING — Bare Steel	☐	☐	☐	☐	☐
Galvanized Steel	☐	☐	☐	☐	☐
Fiberglass Reinforced Plastic	☐	☐	☐	☐	☐
Cathodically Protected	☐	☐	☐	☐	☐
Unknown	☐	☐	☐	☐	☐
Other, Please Specify					
8. Substance Currently or Last Stored in Greatest Quantity by Volume *(Mark all that apply ☒)* EMPTY — **a. Empty**	☐	☐	☐	☐	☐
PETRO — **b. Petroleum** Diesel	☐	☐	☐	☐	☐
Kerosene	☐	☐	☐	☐	☐
Gasoline (including alcohol blends)	☐	☐	☐	☐	☐
Used Oil	☐	☐	☐	☐	☐
Other, Please Specify					
HAZ_SUBST — **c. Hazardous Substance**	☐	☐	☐	☐	☐
Please Indicate Name of Principal CERCLA Substance					
OR Chemical Abstract Service (CAS) No.					
Mark box ☒ if tank stores a mixture of substances	☐	☐	☐	☐	☐
UNKNOWN — **d. Unknown**	☐	☐	☐	☐	☐
9. Additional Information (for tanks permanently taken out of service)					
a. Estimated date last used (mo/yr)	RETIRED	/	/	/	/
b. Estimated quantity of substance remaining (gal.)	REMAIN	GAL			
c. Mark box ☒ if tank was filled with inert material (e.g., sand, concrete)	INERT	☐	☐	☐	☐

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VII Corps
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21st Support Command
ATTN: DEH (12)
USA Berlin
ATTN: DEH (11)
USASETAF
ATTN: DEH (10)
Allied Command Europe (ACE)
ATTN: DEH (3)

8th USA, Korea
ATTN: Facilities Engineer

ROK/US Combined Forces Command 96301
ATTN: EUSA-HHC-CFC/Engr

USA Japan (USARJ)
ATTN: AJEN-DEH 96343
ATTN: DEH-Honshu 96343
ATTN: DEH-Okinawa 96331

416th Engineer Command 60623
ATTN: Facilities Engineer

US Military Academy 10966
ATTN: Facilities Engineer

AMC - Dir., Inst., & Servc (15)
ATTN: DEH (23)

FORSCOM (15)
FORSCOM Engr, ATTN: AFEN-DEH
ATTN: DEH (23)

HSC
ATTN: HSLO-F 78234
ATTN: Facilities Engineer
Fitzsimons AMC 80240
Walter Reed AMC 20012

INSCOM - Ch, Instl. Div
ATTN: Facilities Engineer (3)

MDW, ATTN: DEH (3)

MTMC
ATTN: MTMC-SA 20315
ATTN: Facilities Engineer (3)

TARCOM, Fac. Div. 48090

TRADOC (15)
HQ, TRADOC, ATTN: ATEN-DEH
ATTN: DEH (19)

TSARCOM, ATTN: STSAS-F 63120

USACC, ATTN: Facilities Engr (2)

WESTCOM
ATTN: DEH, Ft. Shafter 96858
ATTN: APEN-IM

FORT BELVOIR, VA 22060 (7)
ATTN: Canadian Liaison Officer
ATTN: British Liaison Officer
ATTN: Australian Liaison Officer
ATTN: French Liaison Officer
ATTN: German Liaison Officer
ATTN: Water Resources Support Ctr
ATTN: R&D Command

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and Fort Bragg
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Norton AFB, CA 92409
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AFESC, Tyndall AFB, FL 32403

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